[simula . research laboratory]

Certus
Centre for Software Verification & Validation

Towards a Systematic Requirement-Based Test Generation Framework: Industrial Challenges and Needs

Shokoofeh Hesari, Razieh Behjati, and Tao Yue
Shokoofeh@simula.no

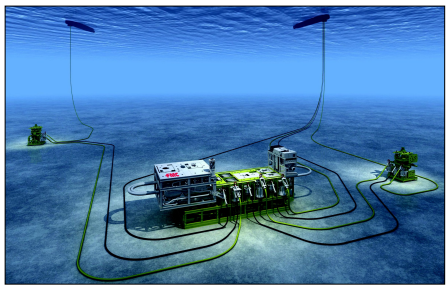
July 17th, 2013
RE'13, Rio de janeiro, Brasil

Outline

- ➜ Collaboration with industry
- ➜ Motivation to automate the reuse of test artifacts
- ➜ General framework of requirement-based test generation (RBTG)
- ➜ Industrial needs for providing automatic reuse of test artifacts
- ➜ Limitations of existing literature and tools
- ➜ Conclusion

Our Industry Partner:

FMC Technologies



- ✓ Subsea Production Systems: Cyber-physical system
- ✓ Product Line Engineering Practice
- ✓ Application of Requirement Based Test Generation (RBTG) for V&V of products

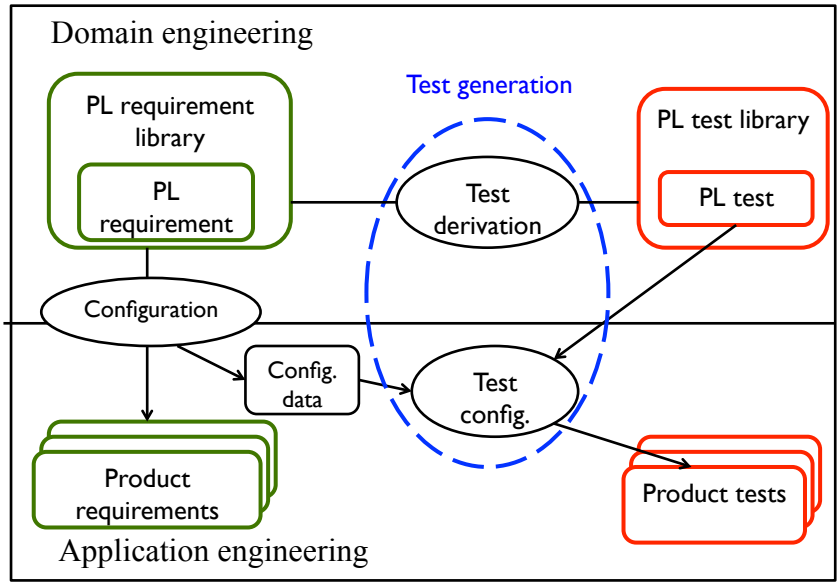
Reuse of system development and test artifacts

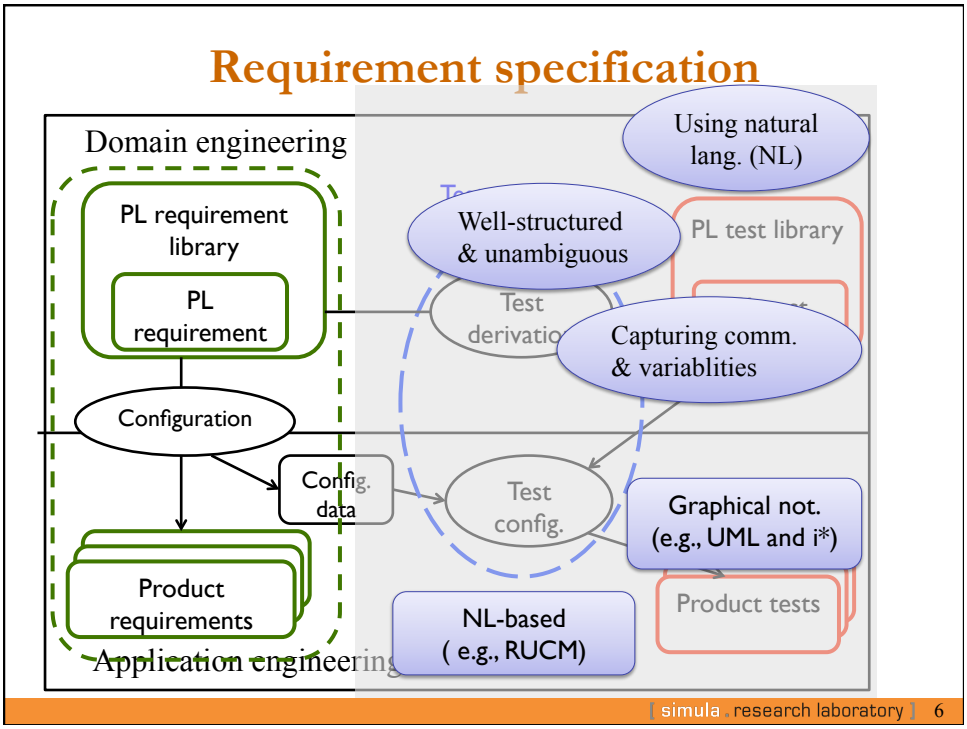
- ➜ Costly test generation
- ➜ Reuse requirements and test artifacts to
  - ➥ Reduce the cost and effort required for supplying test artifacts for each project
- ➜ Seeking for automated solutions for improving reuse

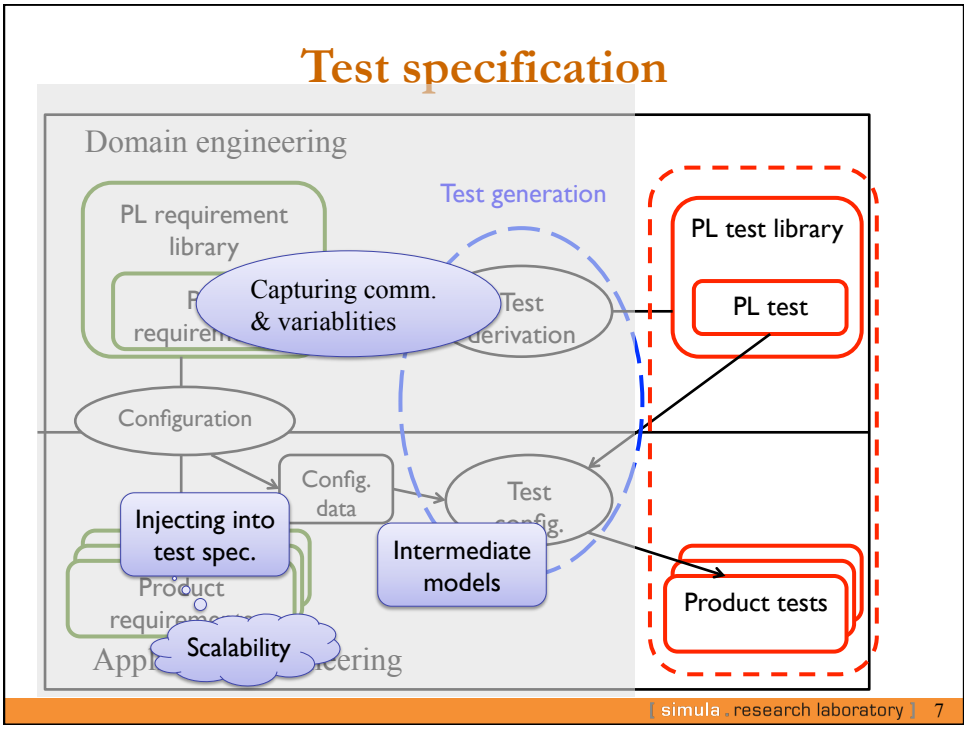
Requirement-based test generation

- ➜ Generation of test artifacts from requirement specification
- ➜ Traceability as an immediate benefit
- ➜ Need a generic framework

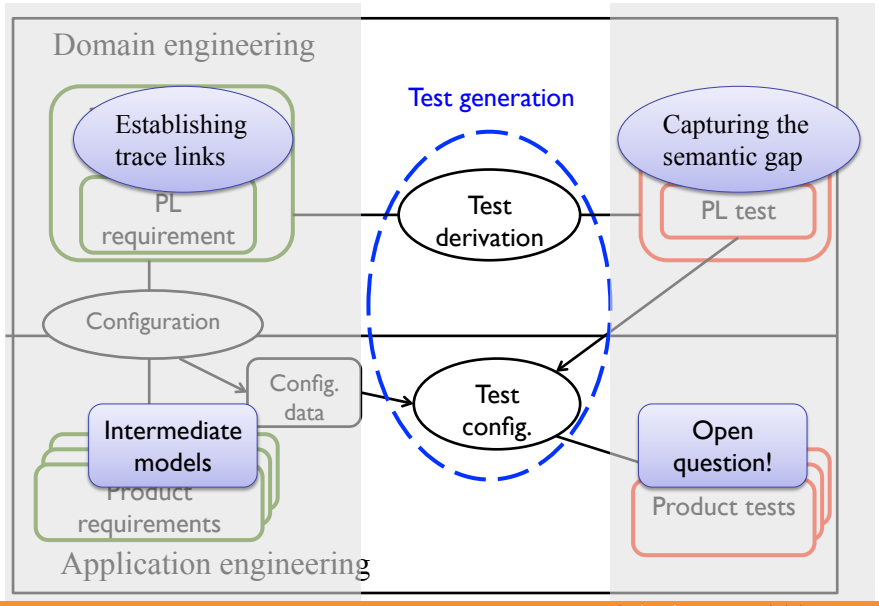
General RBTG framework



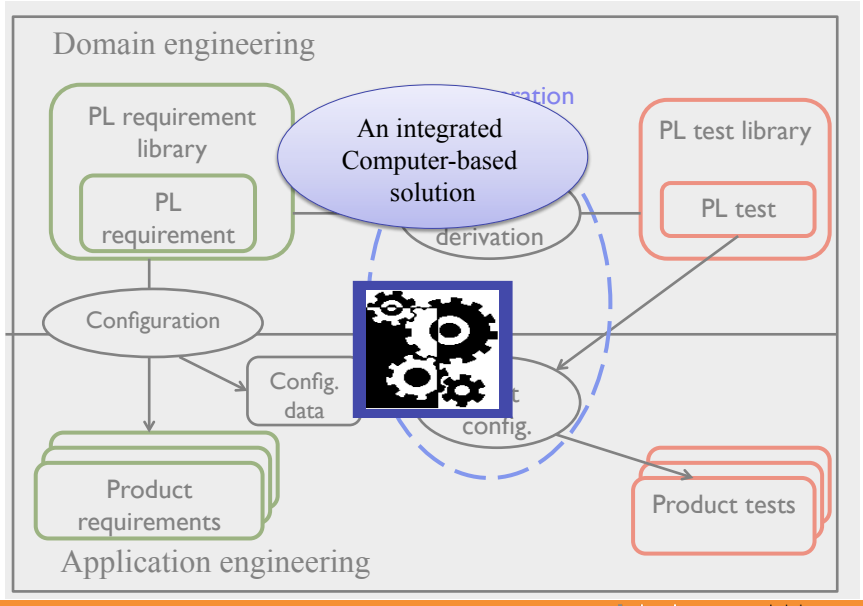

Requirement specification
Domain engineering
PL requirement library
PL requirement
Configuration
Config. data
Product requirements
Application engineering
Using natural lang. (NL)
Well-structured & unambiguous
PL test library
Test derivation
Capturing comm. & variablities
Test config.
Graphical not. (e.g., UML and i*)
Product tests
NL-based (e.g., RUCM)
[simula . research laboratory] 6


Test specification
Domain engineering
PL requirement library
Test generation
Capturing comm. & variablities
Test derivation
Configuration
Config. data
Test config.
Injecting into test spec.
Intermediate models
Product requirements
Scalability
PL test library
PL test
Product tests
[simula . research laboratory] 7

Test generation



Integrated solution



Conclusion and future work

- The formulated open questions
  - Capturing and organizing the commonalities and variabilities in the master documents
  - Assuring the conformance of test and requirement specification with imposed constraints on NL method
  - Affirming the conformance of test configuration with requirement configuration

Thanks

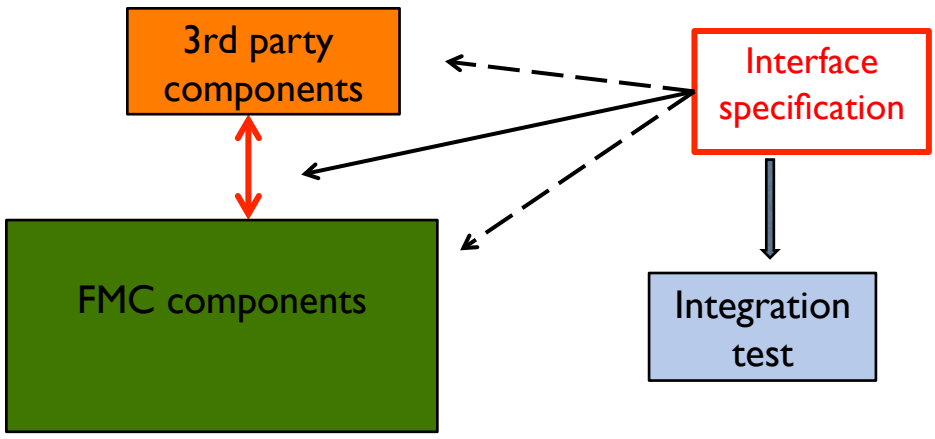
The needs for providing the automatic reuse

- Requirement specification
  - Unambiguous and expressive natural language requirement specification
  - Capturing the commonalities and variabilities of requirements
- Test assets specification
  - Capturing the commonalities and variabilities of test assets (i.e., test artifacts in FMC)
- Test generation
  - Costly and manual test derivation
  - Capturing the semantic gap between configuration of requirements and tests
    - Reusing of requirement configuration data and assuring the conformance of test configuration with requirement configuration is the semantic gap

Analysis of the existing solutions

- A systematic requirement specification
  - Using natural language for constraining and capturing the VPs
  - The requirements (i.e., ISs) we have, are mostly general
    - Problems in finding the VPs
    - Boundary of req (from design and configuration)
- A systematic test specification
  - Capturing VPs in test specification
- Capturing the semantic gap
  - A gap in the literature
- Tool support
  - A need for an integrated framework to support the solution
    - Requirement specification
    - Test specification
    - Semantic gap between the configuration of requirements and tests

Integration process



Goal and the threat

- ➜ Main goal: Reducing the effort of test generation
  - ➥ Solution: automating the reuse of test assets
- ➜ The question is "Do we reuse the good test assets?"
  - ➥ By "good", I mean sufficient quality to assure conformance of the final product to its related requirement